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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,021	11/14/2003	James C. Bartelo	FIS920030197US1	1020

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EXAMINER	
CHU, CHRIS C	
ART UNIT	**PAPER NUMBER**
2815	

DATE MAILED: 03/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/707,021	BARTELO ET AL.	
	Examiner	Art Unit	
	Chris C. Chu	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 – 5, 7 – 10, 12 – 16 and 18 – 21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 – 5, 7 – 10, 12 – 16 and 18 – 21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 17, 2005 has been entered. An action on the RCE follows.

Response to Amendment

2. Applicant's amendment filed on January 27, 2005 has been received and entered in the case.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1 – 5, 7 – 10, 12 – 16 and 18 – 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1 and 12, the term "sufficient" is a relative term which renders the claim indefinite. The term "sufficient" is not defined by the claim, the specification does not provide a

standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. In this case, the term "sufficient" does not establish the metes and bounds of the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1 – 5, 7 – 10, 12 – 16 and 18 – 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. (U. S. Pat. No. 6,819,002).

Regarding claims 1 and 12, Chen et al. discloses in e.g., Fig. 2B and column 3, line 46 – column 4, line 55 an integrated circuit structure (200; column 3, line 26) comprising:

- internal circuitry (active IC devices and circuits; column 3, lines 35 – 37); and
- an interconnect (216, 222, 224, 226, 228 and 232) on an external portion of said structure, said interconnect comprising:
    - a metal layer on a substrate (216; e.g., Al, column 3, lines 41 – 42);
    - a first copper layer (226; Cu, column 3, lines 65 – 67) on said metal layer;
    - a barrier layer (228; e.g., Ni, column 4, lines 6 – 7) on said copper layer;
    - a stabilizing copper layer (232; Cu, column 4, lines 45 – 46) on said barrier layer; and

- a tin-based solder bump (230; e.g., lead-free solders, column 4, lines 24 – 30) on said barrier layer,
- wherein said tin-based solder bump comprises a lead-free solder (column 4, lines 24 – 30), and
- wherein said stabilizing copper layer comprises an amount of copper (column 4, lines 30 – 50).

Furthermore, since the structure recited in Chen et al. is same in structure to that of the claims, the following limitation "sufficient to balance the chemical potential gradient of copper across said barrier layer" is inherent in Chen et al.

Regarding claims 2 and 13, Chen et al. discloses in e.g., Fig. 2B and column 4, lines 45 – 46 said stabilizing copper layer comprising copper which is considered a "sufficient amount". Furthermore, since the structure recited in Chen et al. is same in structure to that of the claims, the following limitation "to prevent copper within said first copper layer from diffusing across said barrier layer" is inherent in Chen et al.

Regarding claims 3 and 14, Chen et al. discloses in e.g., Fig. 2B and column 4, lines 24 – 34 the tin-based solder bump comprising a copper rich solder alloy (column 4, lines 29 – 30; since the copper in the Cu layer 232 dissolves in the Sn-based solder to form Cu/Sn intermetallics, the tin-based solder bump of Chen et al. read as a copper rich solder alloy).

Regarding claims 4, 9, 15 and 20, Chen et al. discloses in e.g., Fig. 2B and column 3, lines 41 – 42 said metal layer (216) comprising diffusion metallurgy including Al.

Regarding claims 5, 10, 16 and 21, Chen et al. discloses in e.g., Fig. 2B and column 4, lines 6 – 7 the barrier layer (228) comprising Ni.

Regarding claims 7 and 18, Chen et al. discloses in e.g., Fig. 2B and column 3, line 46 – column 4, line 55 an integrated circuit structure (200) comprising:

- internal circuitry (active IC devices and circuits; column 3, lines 35 – 37); and
- an interconnect (216, 222, 224, 226, 228 and 232) on an external portion of said structure, said interconnect comprising:
  - o a metal layer on a substrate (216; e.g., Al, column 3, lines 41 – 42);
  - o a first copper layer (226; Cu, column 3, lines 65 – 67) on said metal layer;
  - o a barrier layer (228; e.g., Ni, column 4, lines 6 – 7) on said copper layer;
  - o a copper and tin-based solder alloy bump (230; e.g., lead-free solders with Cu that is dissolved from a Cu layer 232) on said barrier layer,
  - o wherein said copper and tin-based solder alloy bump comprises a lead-free solder (column 4, lines 24 – 30), and
  - o wherein said stabilizing copper layer comprises an amount of copper.

Furthermore, since the structure recited in Chen et al. is same in structure to that of the claims, the following limitation "sufficient to balance the chemical potential gradient of copper across said barrier layer" is inherent in Chen et al.

Regarding claims 8 and 19, Chen et al. discloses in e.g., Fig. 2B and column 3, line 46 – column 4, line 55 said copper and tin-based solder alloy bump comprising a "sufficient amount" of copper. Furthermore, since the structure recited in Chen et al. is same in structure to that of the claims, the following limitation "to prevent copper within said first copper layer from diffusing across said barrier layer" is inherent in Chen et al.

Response to Arguments

7. Applicant's arguments with respect to claims 1, 7, 12 and 18 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is 571-272-1724. The examiner can normally be reached on 11:30 - 8:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 517-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chris C. Chu
Examiner
Art Unit 2815

c.c.
Thursday, March 17, 2005

GEORGE ECKERT
PRIMARY EXAMINER